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# Agricultural Water Transfers in China: Current Issues and Perspectives

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**Abstract**

Water transfers from agricultural to industrial or domestic uses are becoming increasingly common in China. Water conflicts can be partly considered as the consequence of water transfer failures. In this paper, data of water use in recent years were reviewed and cases of water transfers were presented. Current issues were analyzed and some measures were proposed for enhancing water use efficiency, productivity and equity. It ends with implications for regional water management strategies and policy reform. It is concluded that the decisions of water reallocation under water stress should be shared by all communities, especially the availability of the basic water need for all water use sectors.



*Keywords:* water transfers; food security; water policy; water rights

## 1. Introduction

China is marked by its large population, rapid urbanization, unsustainable agriculture and industrial development which in turn affect the water use. Agriculture accounts for the majority of global water withdrawals, and is often responsible for 80% or more of total withdrawal for consumptive uses in developing countries [1]. Since some existing uses within agriculture may have relatively low value of water at the margin, it is likely that a significant majority of transfers will involve agriculture [2], [3]. In China, growing demand of domestic and industrial water use squeezes agricultural water uses.

Agriculture is a predominant factor of global food security; many developed countries have implemented new allocation policies, which cause the least disruption to agriculture output and the

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livelihoods of farmers (especially poor farmers) [4], [5]. Farmers in China should get more compensation since they live on cultivation and the process of water transfer accused them of jeopardizing their livelihoods [6].

## 2. Recent trends in water consumption

We collected data from China Water Resources Bulletin for the years from 1997 to 2008 (http://www.mwr.gov.cn). Figure 1 illustrates the water consumption of different sectors. From 1997, the whole country's water consumption kept rising steadily, though, there were some drops. Providing the high pace of industrialization, domestic and industrial water uses gradually increased, especially for the industry part, from around 100 billion cubic meters (BCM) to nearly 150 BCM. On the other hand, the agriculture water use reduced to 360 BCM in 2008 from about 400 BCM in 1997, while the industrial water use grew from 110 BCM to 140 BCM, and domestic use from about 52 BCM to 73 BCM. From 2003, about 10 BCM water were used for ecological or environmental use. The percentages of agricultural water use significantly decreased from 70% in 1997 to about 62% in 2008. These data showed that agricultural water was transferred to other uses, including industrial, domestic or ecological or environmental uses.

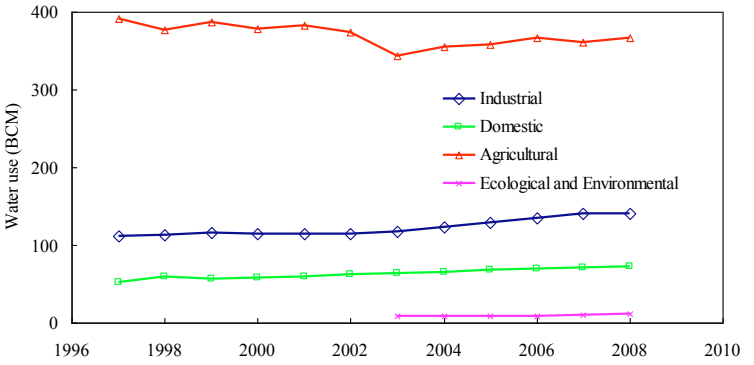


Figure 1. Water use from 1997 to 2008

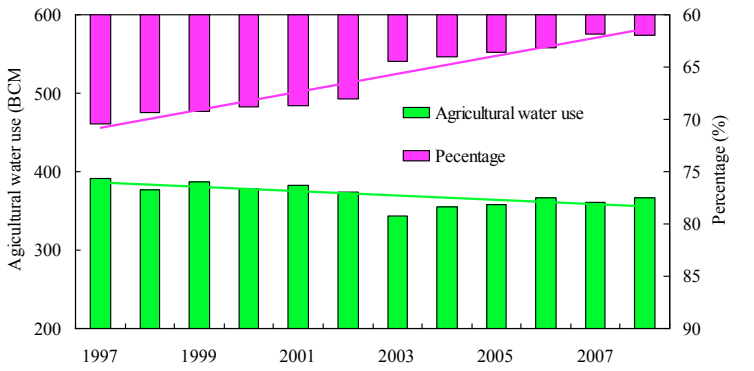


Figure 2. Percentages of agricultural and industrial water uses from 1997 to 2008

## 3. Cases of agricultural water transfers

Irrigation water for large and medium irrigation districts in China is usually from reservoirs, and some of the reservoirs also have other functions such as hydropower generation and flood control. Water transfers are often implemented through modification of reservoir operations. Zhanghe Reservoir in Hubei Province was designed for multiple uses: irrigation, flood control, domestic water supply, industrial use, aquaculture, and hydropower generation. The reservoirs and diversion canals were originally designed for irrigation, but now larger priorities are given to hydropower generation and urban water supply. Consequently, reservoir release was driven by energy demand and domestic water use instead of crop water requirements. Farmers used to obtain water from the reservoir through canals when drought occurred. In the summer of the year 2000, the counties in north-eastern Hubei Province were hit by a serious drought. However, in that year, farmers did not get water for many days. Farmers complained that the reservoir authority tried to hold water as long as possible for the newly developed tour business at the reservoir site [5, 7].

Hengshan Reservoir in Jiangsu Province was designed and built for irrigation in 1960s. In recent years, water bodies in the lower Tai Basin were polluted and not suitable for domestic use, thus from 2003, water in the upstream Hengshan Reservoir was diverted to domestic use of the down stream Yixing City. The unpleasant consequences accompanied the successful transfer, since no water for irrigation, rice production dropped year by year; the shortage of the rural drinking water also posed a threat; farmers gave up their original livelihood.

There is also a case of water shifting due to tourism. Tianmu Lake Tourist Resort is located in south Jiangsu Province, approved by Jiangsu province government in July 1992. Before it was completed, the Shahe Reservoir was used for irrigation and flood control. In order to ensure the operation of Tianmu Lake tourism industry, the reservoir had to maintain the water level, which leaded to reduction in irrigation water.

Agricultural water transfers are even more needed and have been undertaken much more extensively around urban areas. A typical case about Beijing municipality and neighboring agricultural counties was described by Peisert and Sternfeld [8]. To protect water quantity and quality supplied to the Beijing municipality, restrictions had been established for land and water uses and agricultural development in some counties. The cause of the urban–rural water conflicts sparked by Beijing's growing municipal water demands was the burden of restructuring the county's agricultural sector. In 2001, the government of Miyun County announced it would completely abandon growing cereals, and instead develop perennial cultures, mainly fruit trees.

## 4. Problems in agricultural water transfers

Agricultural water transfers in China are still in a primary stage, which is lack of experience and legal protection. Most importantly, the initial water right allocation has not been established yet. The initial water right is one of the usufruct which is base on that the government hold the proprietorship of the water resources. The specific initial water right makes for the allocation of water resources [9]. On the other hand, the right of using water resources between departments has been ill-defined and is controlled by many services. Various departments have water disputes with others or contradiction with multi-function of water resources since they think of their own [10].

The priority is to establish the water legislation. From the Sections 21, 26 and 27 of the Water Act, it can be seen that, these provisions are not provided in the form of the sequence order of the various water rights, and most of them take a relatively flexible arrangement. But the growing demands of agricultural water use need a stable status. Legislation is required to determine the irrigation water, industrial water,

and other eco-specific water use sequences. The water market can only function properly after the establishment of legal framework of objectives. Through the water between the main markets for water trading and water right conservation, they can clarify the redistribution of water rights.

Multi-party transactions involving water rights trading therefore need a wide range of oversight mechanisms should include governmental and non-governmental oversight, the former via laws and regulations, the later are mainly social intermediary organizations, civil society, media and farmers involved in monitoring, such as Association of rural irrigation water.

Government and company should be responsible for the water conflicts due to unreachable or undesired scale of compensation. In the Hengshan water transfer case, the government request the transfer completed in three years, the first year, to compensate 4500 Yuan per hectare, the second year 3000, and the third year 2250. This does not guarantee the basic needs for the farmers. Farmers are pros and cons of water rights trading centre of interest, should form a water group to protect the interests of grassroots self-management.

## 5. Conclusion

It will be increasingly difficult to reach the growing supply/demand imbalance in China if new demands from one sector are met while decreasing supplies to another. It should be noted that in China, agriculture holds a special place in rural livelihoods and national food security, which means remaining a high priority. Water shifting from agriculture to other sectors has already disadvantaged the equity and social stability. Therefore it should take basic needs of all stakeholders into consideration. Legislation and basic rules are immediately needed. In addition, the supervisory authority should also participate into the water right transfers.

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## References

[1] Mark W. Rosegrant, Claudia Ringler., 2000. Impact on food security and rural development of transferring water out of agriculture. *Water Policy*, 1 (6): 567-586.

[2] National Research Council, 1992. *Water transfers in the west: efficiency, equity, and the environment*, National Academy Press, Washington, DC.

[3] Howitt, P., Water market-based conflict resolution. In:Sanchez, R.G., Woled,J. (Eds.),*Resolving conflict in the management of water resources, Proceedings of the First Biennial Rosenberg International Forum on Water Policy*. September 28-30, 1997, San Francisco, California. Water Resources Report No. 93, Centers for Water and Wildland Resources, University of California, Davis.

[4] Li Guo, Qiang Cui., 2010. Wujiang River water rights legal protection of agricultural research system. *Anhui Agricultural Sciences*, 38 (1): 434-436. (in Chinese)

[5] Ximing Cai, 2008. Water stress, water transfer and social equity in northern China- implications for policy reform. *Journal of Environmental Management*. 87 (1): 14-25.

[6] Hao Wang, Lianwen Dang, Li wang, et al.,2006. The construction of China's water rights. *China Water Conservancy*. 1: 28-30. (in Chinese with English abstract)

[7] R. Loeve, B. Dong, L. Hong, et al, 2007. Transferring water from irrigation to higher valued uses: a case study of the Zhanghe irrigation system in China. *Paddy and Water Environment*, 5:263–269

[8] Peisert, C., Sternfeld, E., 2004. Quenching Beijing's thirst: the need for integrated management for the endangered Miyun reservoir. *China Environment Series* 7: 33–45.

[9] Haihong Li, Jianshi Zhao, 2005.The Principle of the Initial Water Right and the Practice Method (in Chinese with English abstract). *Journal of Basic Science and Engineering*. 13: 8-14.

[10] Jie Zhang, Jigan Wang, 2008. Comparative Study on Water Right Trade Management. *Ecological Economy*. 9: 68-71. (in Chinese with English abstract)